(12) UK Patent Application (19) GB (11) 2 233 561 (13) A

(43) Date of A publication 16.01.1991

(21) Application No 8915657.4

(22) Date of filing 07.07.1989

(51) INT CL[5]
A61B 17/02

(52) UK CL (Edition K)
A5R REY

(56) Documents cited
GB 2107990 A GB 2102681 A GB 1283429 A
EP 0261284 A1 US 4337762 A US 4010741 A

(58) Field of search
UK CL (Edition J) A5R REY, F2K K4B4
INT CL[4] A61B

(71) Applicant
Engineering in Medicine Limited

(Incorporated in the United Kingdom)

130 Buckingham Palace Road, London, SW1W 9SA, United Kingdom

(72) Inventor
Edmund Jan Bonikowski

(74) Agent and/or Address for Service
Kilburn and Strode
30 John Street, London, WC1N 2DD, United Kingdom

(54) Workpiece holding or positioning means

(57) A surgical retractor assembly comprises a rail (1) in the form of a ring which is adjustably supported by legs (4) above the patient from the operating table. A carriage (7) is mounted on the rail and carries a retractor (14). The retractor is mounted on one end of a first arm (13) the other end of which is pivoted to the upper end of a second arm (12) the lower end of which carries a ball (11) which is mounted in a socket (9) in the carriage. The ball can be locked by a manually operated wedge (32) which also causes a rod (47) extending up a bore in the second arm to lock the pivot between the first and second arms. Operation of the wedge also locks the carriage in position on the rail. Thus, the retractor can be positioned as desired and then a single simple operation causes the wedge to hold the retractor in this position.

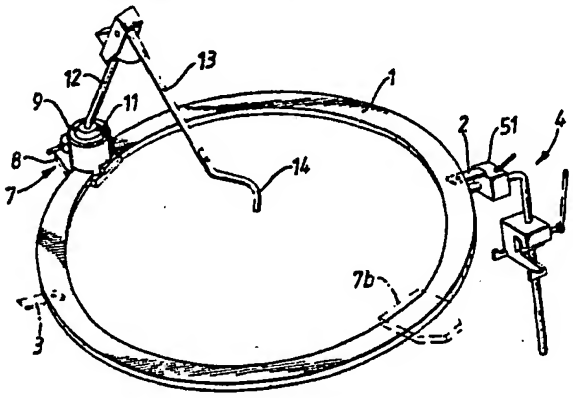

Fig.1.

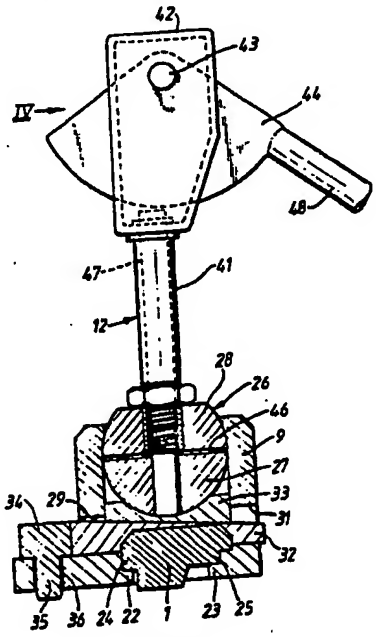

Fig.3.

GB 2 233 561 A

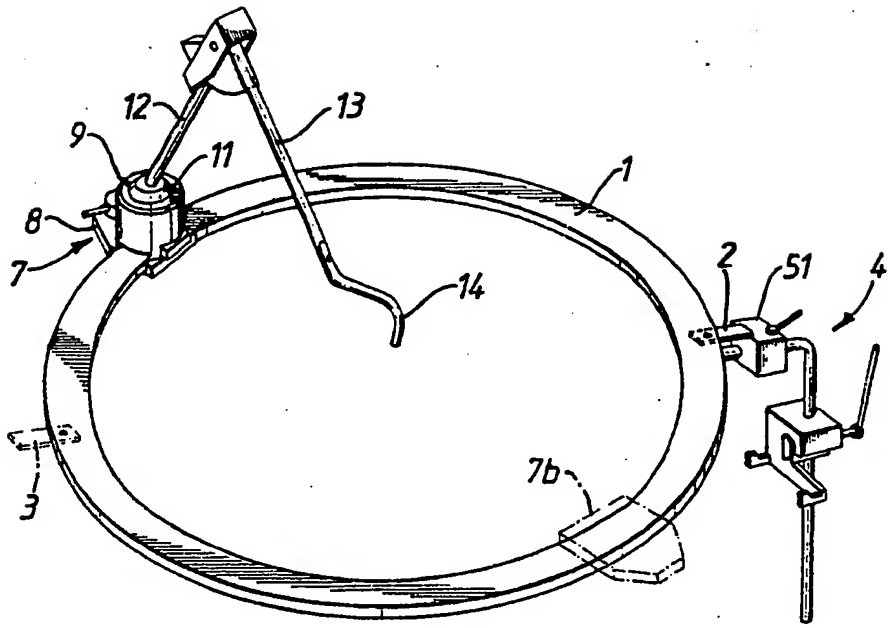

Fig.1.

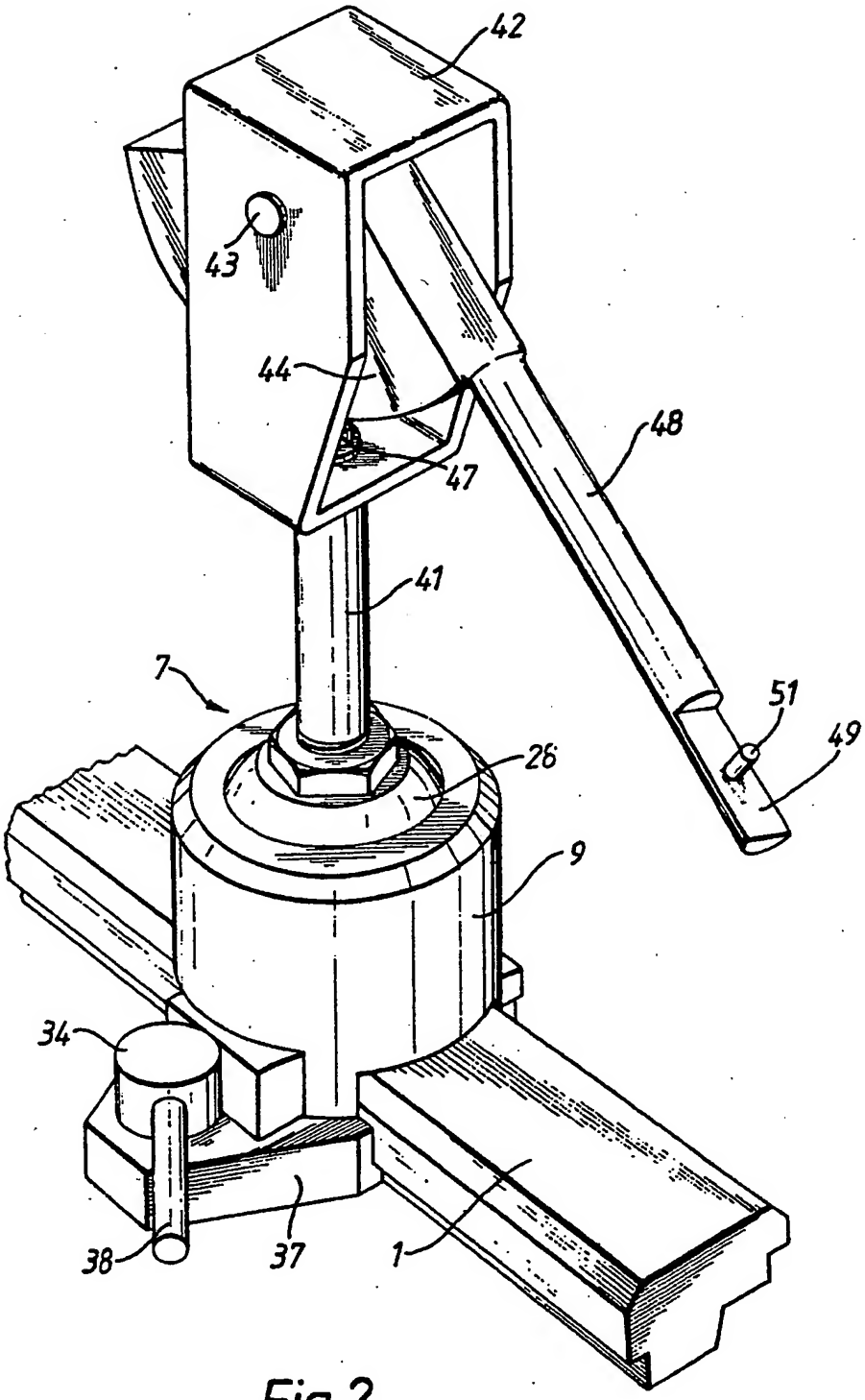

Fig.2.

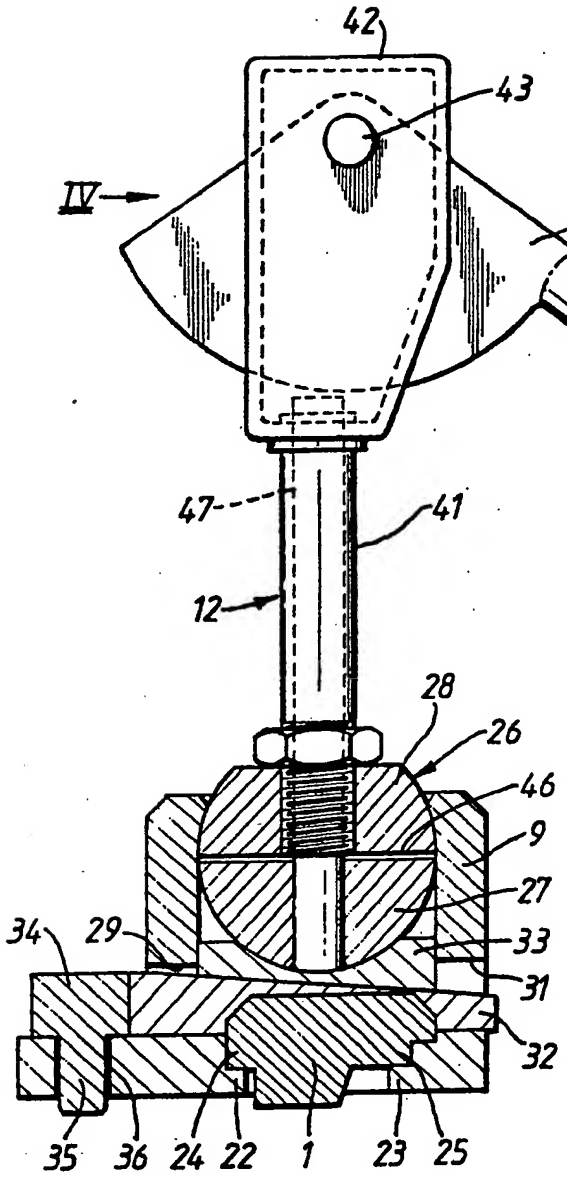
42
43
IV
44
48
47
41
12
28
26
46
9
27
34
29
33
31
32
35
36
24
22
1
23
25

Fig.3.

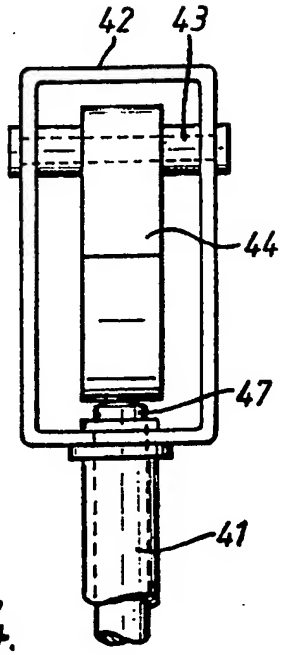
42
43
44
47
41

Fig.4.

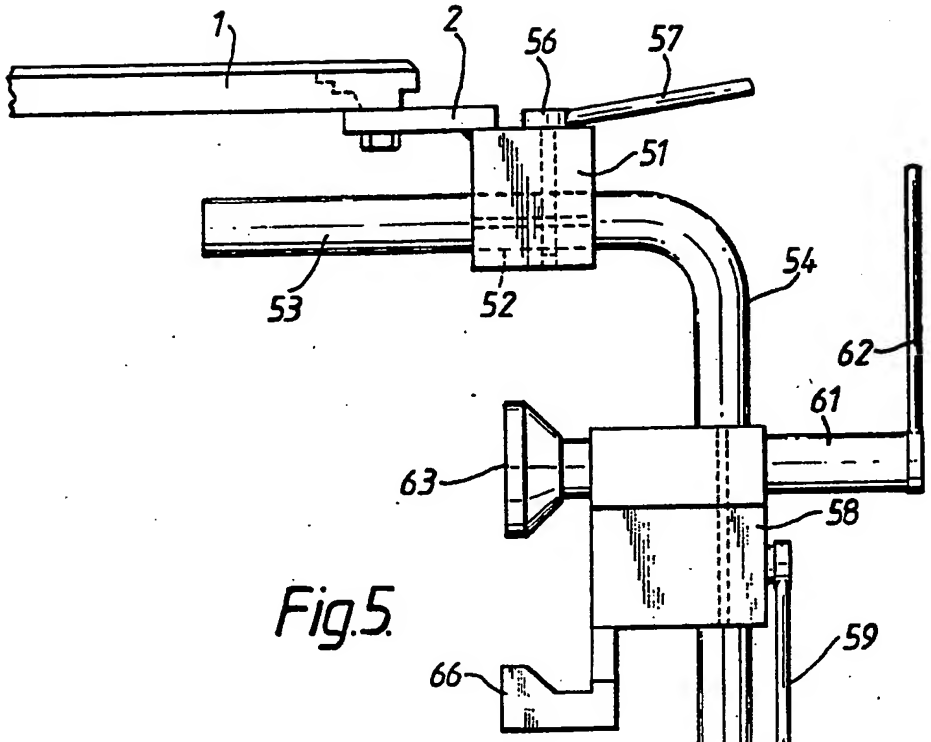

Fig.5.

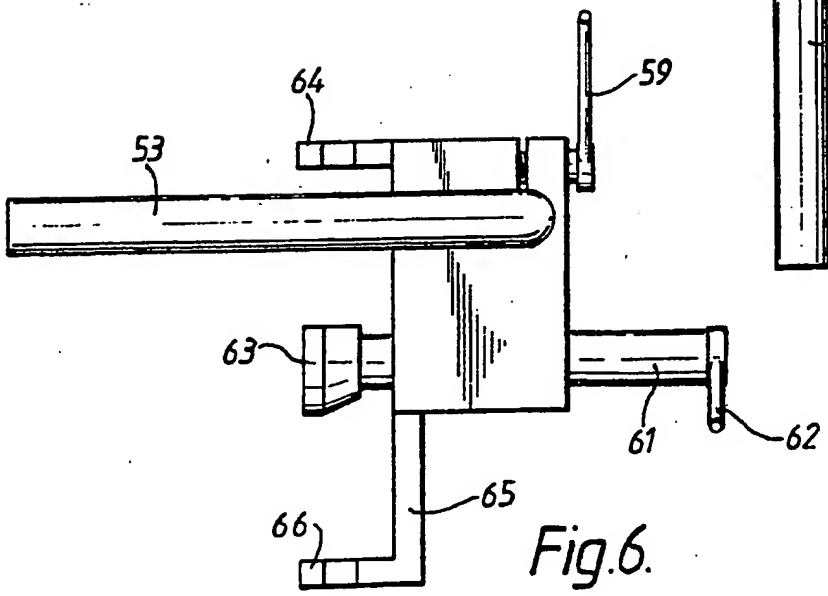

Fig.6.

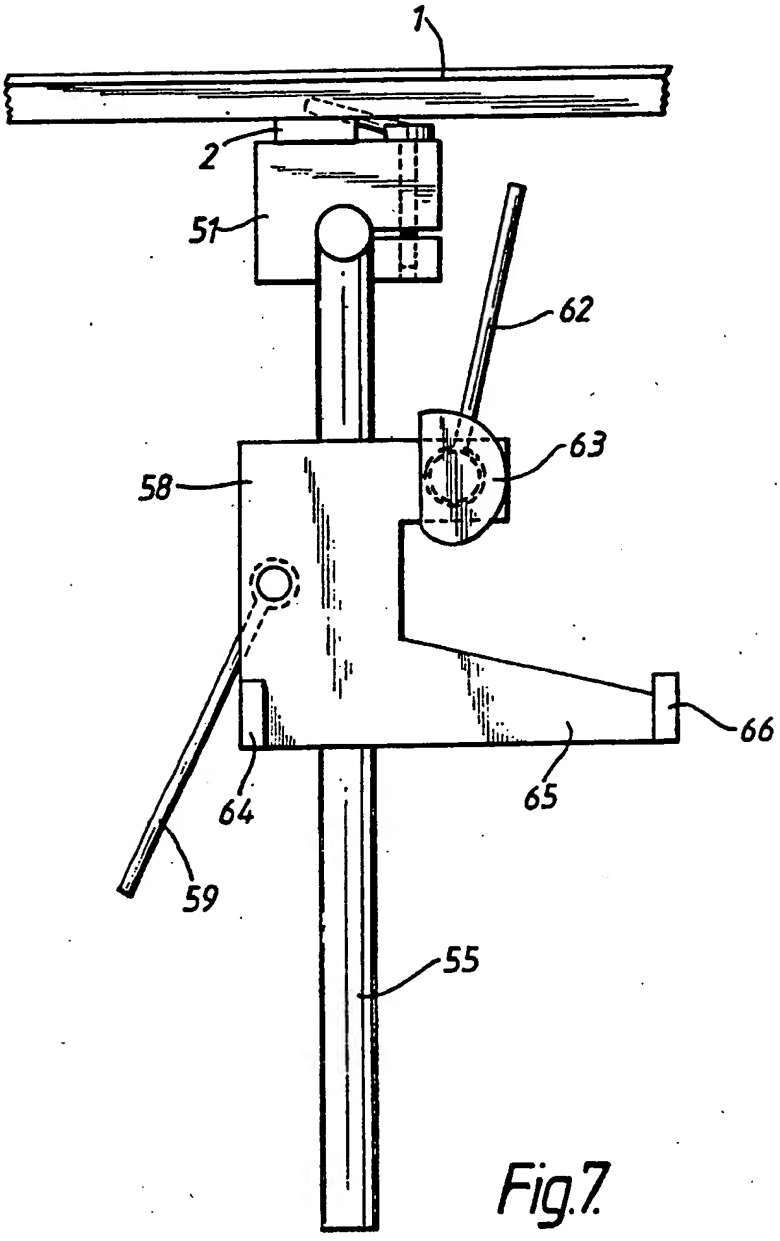

Fig.7.

Workpiece Holding or Positioning Means

This invention relates to means for positioning or holding a workpiece and the term work piece is intended to be understood broadly since the invention is particularly applicable to retractors for use in surgical procedures. It will be understood that in this case the workpiece is a part of the body of the patient. Although the invention is primarily concerned with retractors it will become apparent that the invention provides means which may be used in other fields, for example to hold an inanimate workpiece while operations are performed on it.

According to usual operating theatre procedures suitably shaped retractors are held by hand, inserted into an incision and pulled in an appropriate direction to create an opening of sufficient size to enable a surgeon to operate. In any but the simplest and shortest operations this method quickly causes fatigue to the assistants holding the rectractors with consequent loss of positional precision causing difficulties to the surgeon and, in long operations, requiring additional assistance. This situation can be much improved by the use of retractor assemblies which, once positioned, will remain in place as long as required by the surgeon. Examples of such assemblies exist but they have substantial disadvantages and in general they are complicated, cumbersome and difficult to use and take a considerable time to set up.

According to one aspect of the present invention, a surgical retractor assembly comprises a rail, a carriage movable along the rail, a retractor attached to the carriage by means permitting pivotal and/or

rotational movement of the retractor relative to the carriage, and a wedge arranged to simultaneously lock the carriage to the rail and the relative movement of the retractor.

According to a second aspect of the present invention a clamp assembly comprises a body forming a ball socket, a ball in the socket carrying a shaft the upper end of which carries a member connected to the shaft by a pivot having a pivot axis generally transverse to the longitudinal axis of the shaft, a wedge arranged to lock the ball in the socket, and locking means interconnecting the pivot and the ball and arranged to lock the pivot when the ball is locked.

According to a third aspect of the invention, a clamp assembly comprises a body forming a ball socket, a part-spherical ball element in the socket and carrying a first arm section, a second arm section connected to the outer end of the first section by a pivot, a rod extending generally parallel with the first arm section and having one end engaging the second arm section and having the other end operatively engaging one side of a wedge the other side of which is in operative engagement, with the socket, movement of the wedge in one direction tightening the ball element against the socket, pressing the rod against the second arm section, and tensioning the first arm section to render the assembly rigid.

The invention may be carried into practice in various ways but one form of retractor assembly embodying the present invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a simplified perspective view of the

complete assembly;

Figure 2 is an isometric view of a clamp for a single retractor mounted on the ring of the assembly;

Figure 3 is a vertical or axial section through the clamp shown in Figure 2;

Figure 4 is a fragmentary elevation seen in the direction of the arrow IV in Figure 3 of the upper part of the clamp;

Figure 5 is a front elevation to a larger scale of the means of support of the assembly shown in Figure 1;

Figure 6 is a plan view of the means of support shown in Figure 5 but with parts omitted, and

Figure 7 is a side elevation of the means of support shown in Figures 5 and 6.

The assembly shown in Figure 1 comprises a rigid ring 1 whose cross section can be seen from Figures 2 and 3, the ring being provided with a radially extending arm 2 which is provided with support means 4, to be described later, for attachment to one of the rails which run lengthwise along the sides of standard operating tables. The ring 1 can thus be positioned above the site of the intended incision in the patient and although it will usually lie in a horizontal plane the support means 4 provides for rotation of the ring about the longitudinal axes of the arm 2 so that it can be tilted to be higher towards the head end than the foot end of the patient or vice versa. A second radially extending arm 3 and a further support means may, if desired, be provided on the other side of the table.

Mounted on the ring 1 is a plurality of clamps 7 only one of which is shown but the position of an additional one of which is indicated by dotted lines

7b. Broadly speaking the clamp 7 comprises a body 8 which is slidable along the ring 1, a socket portion 9 extending upwardly from the base 8 and containing a ball assembly 11, a first arm 12 moving with the ball and a second arm 13 pivoted to the upper end of the arm 12. A retractor blade 14 is attached to the outer end of the arm 13.

Attention is now directed to Figures 2, 3 and 4 which show the clamp in greater detail. The socket portion 9 of the clamp 7 is generally cylindrical and the lower portion thereof is shaped to provide an opening or groove to receive the ring 1, the edges of the opening being formed as inwardly directed flanges 22,23 to engage underneath the flanges 24,25 which project from the upper parts of the outer and inner sides of the ring 1 respectively. At the upper end of the bore of the cylindrical portion 9 the inner surface curves inwardly to provide a part-spherical inner surface to engage a part of the surface of a ball assembly 26 consisting of a lower hemispherical portion 27 and an upper truncated hemispherical portion 28. In the lower part of the cylindrical wall 9 there are two diametrically opposite openings 29,31 through which a wedge member 32 passes beneath the ball assembly 26 and above the ring 1. A seat member 33 is interposed between the ball assembly 26 and the wedge 32, the upper surface of the seat member 33 having a part-spherical depression corresponding to the surface of the ball assembly 26 and the lower surface being inclined in the direction which is complementary to the upper surface of the wedge 32. As will be explained below, when the wedge member 32 is moved to the right the whole clamp assembly is locked up tightly, the

lower side of the wedge member 32 pressing against the upper surface of the ring 1 which in turn presses on the flanges 22,23 of the body of the clamp member and the upper surface of the wedge member 32 pressing through the seat member 33 against the ball assembly 26 which in turn is pressed against the inwardly curved upper part of the bore in the cylindrical part 9 of the clamp member.

Means are provided for moving the wedge member 32 to the right as seen in Figure 3, such means comprising a cam or eccentric 34 which carries an off-centre pivot pin 35 carried in a bore 36 in a bracket portion 37 integral with and projecting laterally from the lower part of the cylindrical portion 9. The cam carries a radially extending handle 38 by which it may conveniently be rotated. The geometry of the cam 34 and the wedge member 32 and the coefficients of friction between the surfaces of these members and the surfaces with which they react are sc selected that the wedge is effectively self-locking and once it is moved into a locking position it will not become free without deliberate rotation of the handle 38.

Rigid with the upper hemispherical member 28 of the ball assembly 26 is an outer sleeve 41 carrying at its upper end a yoke 42 between the arms of which there extends a shaft 43 forming a pivot with an axis transverse to that of the sleeve 41 and mounting a quadrant plate 44 to which is fixed a rod 48 which constitutes the outer arm 13 shown in Figure 1. As can be seen in Figure 2 the outer end of the rod 48 has a cut-out 49 from which projects a locating pin 51. A retractor blade having a shaft including a cut-out complementary to the cut-out 49 and a hole to receive

the pin 51 is attached to the rod 48 and is secured in position by a sleeve which slides along the rod 48.

A rod 47 slides within the sleeve 41 and the rod 47 and the sleeve 41 together constitute the arm 12 shown in Figure 1. The lower end of the rod 47 is fixed in a bore in the lower hemispherical portion 27 of the ball assembly while the upper end of the rod 47 is rounded and engages the arcuate surface of the quadrant plate 44. The length of the rod 47 is such that there is always a small gap 46 (Figure 3) between the upper and lower hemispherical portions of the ball assembly.

The described apparatus is used as follows. The ring 1 is set up over the site of the incision as will be described and the incision made. A clamp 7 is then placed on the ring, the clearances between the body of the clamp and the ring 1 being such as to permit positioning of the clamp on the ring by appropriate manipulation. The retractor 14 is then positioned by the surgeon as required and is then locked in place by operation of the handle 38 thus moving the wedge 32 inwards and locking the assembly. Inward movement of the wedge 32 raises the lower hemispherical portion 27 of the ball assembly, thus forcing the upper end of the rod 47 hard against the quadrant plate 44 to lock frictionally the quadrant plate and hence the rod 48 and the retractor in position. The reaction from the engagement of the upper end of the rod 47 against the quadrant plate 44 is taken through the shaft 43 the yoke 42 and the sleeve 47 to the upper hemispherical portion 28 which is pressed against the inturned upper end of the socket portion 9 to clamp the socket assembly tightly in place. Thus, the ball assembly is

unable to move through any of its degrees of freedom. The sleeve 41 is unable to rotate so that the yoke 42 and in turn the rod 48 are unable to rotate about the longitudinal axis of the sleeve 41. Accordingly, the position of the retractor is fixed and will not change until the cam 34 is moved to the release position and the wedge 32 is moved back.

It will be appreciated that retractor blades of various constructions and shapes can be attached to the rod 48 to suit the immediate requirements of the surgeon. One particular advantage to be obtained by use of the apparatus is that the retractor can be used to apply upward force to the flap of the patient revealed by the incision as compared with the earlier mechanical retractors by use of which it is difficult to apply anything other than a horizontal force.

The support means 4 shown in Figure 1 will now be described in greater detail with reference to Figures 5, 6 and 7. As previously mentioned, the ring 1 carries a radially extending arm 2 which may be connected to support means 4. The arm 2 is welded to a block 51 formed with a bore 52 which, when the apparatus is in its operative position, extends generally horizontally and radially of the ring 1. The bore 52 receives the return portion 53 of a rod 54 which is generally of inverted L-shape and the vertical limb 55 of which provides a support column for the apparatus. The block 51 is formed with a horizontal split extending from one side to the bore in a plane containing the axis of the bore and the two sides of the bore are connected by a clamping screw 56 which is freely rotatable in a vertical bore in the part of the block 51 above the split and which extends into a

threaded bore in the part of the block below the split. The screw 56 carries a lever shaped handle 57 rotation of which in one direction causes the split to close so that the return portion 53 of the rod 54 is gripped tightly in the block 51. In a similar manner the vertical limb 55 of the rod 54 passes through a vertical bore in a block 58 in which it can be clamped by means of a lever 59 closing a split in the block. The block 58 also has a horizontal bore through which extends a shaft 61 carrying an operating lever 62 at one end and a locking cam 63 at the other end. At one lower corner of the block 58 there is a hook 64 which extends away from the block radially inwardly of the ring 1 and has a return portion turning upwards. From an adjacent corner there is a horizontally extending arm 65 which carries at its distal end a hook 66 similarly arranged to the hook 64.

The ring 1 is set up as follows. With the rod 54 loosely positioned in the block 58 the hooks 64,66 are positioned under the longitudinal rail extending along one side of the operating table with the cam 63 positioned above the rail and the lever 62 is then rotated to cause the locking cam 63 to grip the rail between the cam and the hooks 64 and 66 so that the block 58 is rigidly secured to the rail. The height of the ring is then adjusted by moving the rod 54 up and down in the vertical bore in the block 58 and it is then locked in position by rotation of the lever 59. The lateral position of the ring can then be adjusted by sliding the block 51 along the return portion 53 of the rod 54 and when it is in position it can be clamped by operation of the lever 57.

It will be noted that the various locking

operations are effected by rotation of easily manipulated levers and the device can be set up in a very short time indeed.

Although the invention has been described in relation to a retractor for surgical operations the mechanism described can be used in other environments where there is a requirement to lock a tool or workpiece in a position in space. For example, in place of the retractor blade 14 the arm 13 could carry a chuck or holder to carry a workpiece to be operated on or a specimen to be examined.

Claims:

1. A surgical retractor assembly comprising a rail, a carriage movable along the rail, a retractor attached to the carriage by means permitting pivotal and/or rotational movement of the retractor relative to the carriage, and a wedge arranged to simultaneously lock the carriage to the rail and the relative movement of the retractor.

2. An assembly as claimed in claim 1 in which the rail is circular.

3. An assembly as claimed in claim 1 or claim 2 or which includes means for supporting the rail from an operating table.

4. An assembly as claimed in claim 1 or claim 2 or claim 3 in which the retractor includes a pivot separate from the attaching means, the said pivot being also locked by the wedge.

5. A retractor assembly substantially as described herein with reference to the accompanying drawings.

6. A clamp assembly comprising a body forming a ball socket, a ball in the socket carrying a shaft the upper end of which carries a member connected to the shaft by a pivot having a pivot axis generally transverse to the longitudinal axis of the shaft; a wedge arranged to lock the ball in the socket, and locking means interconnecting the wedge and the pivot and arranged to lock the pivot when the ball is locked.

7. An assembly as claimed in claim 6 in which the ball comprises a first portion to which the shaft is fixed and a second portion carrying a sleeve through which the shaft passes, the said member being pivoted to the sleeve and hence to the shaft.

8. An assembly as claimed in claim 7 in which the said member carries a quadrant and the shaft engages the periphery of the quadrant to lock the pivot.

9. An assembly as claimed in claim 8 in which the sleeve carries a yoke in which the quadrant is pivoted, the shaft engaging the quadrant within the yoke.

10. An assembly as claimed in any of claims 6 to 9 in which the member comprises an arm carrying a surgical retractor at its outer end.

11. An assembly as claimed in any of the preceding claims in combination with a rail on which the assembly is clampably movable.

12. An assembly as claimed in claim 11 in which the assembly is clampable on the rail by the wedge.

13. An assembly as claimed in any of claims 6 to 12 which includes a cam or eccentric mounted on the socket and arranged to translate the wedge to its locking position.

14. An assembly as claimed in claim 13 which includes a handle for manual rotation of the cam or eccentric.

15. A clamp assembly comprising a body forming a ball socket, a part-spherical ball element in the socket and carrying a first arm section, a second arm section connected to the outer end of the first section by a pivot, a rod extending generally parallel with the first arm section and having one end engaging the second arm section and having the other end operatively engaging one side of a wedge the other side of which is in operative engagement with the socket, movement of the wedge in one direction tightening the ball element against the socket, pressing the rod against the second arm section, and tensioning the first arm section to render the assembly rigid.

16. A clamp assembly substantially as described herein with reference to Figures 2 to 4 of the accompanying drawings.

Published 1991 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office.